

Energy Efficiency and Radon: Guide for Renovation

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BC LUNG
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About our program. The BC Lung Foundation's Healthy Indoor Environments program is focused on providing education, resources, and policy options for addressing priority indoor air pollutants in British Columbia. Canadians spend 90% of their day indoors, with about 70% at home and 20% at work or school. The air we breathe indoors can contain particulates, gases, allergens and fumes that can significantly affect our health in both the short and long term. Knowing the main indoor air pollutants, their sources, and how to reduce them are key to reducing harm to our health. Radon has been identified as the leading environmental carcinogen in Canada.

For more information visit our website at <https://bclung.ca/programs-initiatives/healthy-indoor-environments-program>

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Introduction

Radon is a radioactive gas generated by the natural decay of uranium in the soil and rock below and around buildings. It can enter homes through holes and cracks. Radon is the leading cause of lung cancer, after smoking, causing 16 percent of lung cancer deaths in Canada. Health Canada has set a Radon Guideline of 200 Bq/m³. When testing shows a home is at or above this Guideline, systems should be installed to reduce radon levels as low as reasonably achievable. Radon risks increase with length and concentration of exposure and there remains some lung cancer risk at 200 Bq/m³— the World Health Organization suggests 100 Bq/m³ as the appropriate action level and the United States' action level is 148 Bq/m³ (4 pCi/L).

[BC Lung research on Energy Efficiency and Radon](#) confirms that energy efficiency renovations can increase radon levels in homes. All homes have some levels of radon, and it is likely that an energy efficiency measure can increase radon levels through changing reducing natural (unplanned) ventilation or air pressures.

- In [Energy Efficiency and Radon: Making the Connection](#) our scientific advisors review academic literature that makes the link.
- In [Energy Efficiency and Radon: Recognizing Legal Liabilities](#) our lawyer reviews the law and finds there is a duty of care on personnel in the energy efficiency industry to ensure home occupants are not put at increased risk of lung cancer. Clients should be warned about radon risks and renovators take steps to minimize or prevent that risk.
- In [Energy Efficiency and Radon: Gaps in the System](#) we analyze the current energy efficiency system in Canada and find serious gaps in protection from radon.
- In [Energy Efficiency and Radon: Solutions Moving Forward](#) we suggest concrete policy changes, including new guidance from Natural Resources Canada, ensuring energy advisors are trained in radon, and that radon mitigation be considered a vital part of the energy upgrade process by contractors, grant programs, and lenders.

Here, we set out in point by point form specific recommended steps for renovators to ensure they meet the requisite standard of care to ensure renovations do not cause harm from radon. This document draws on the [US EPA's Energy Savings Plus Health: Indoor Air Quality Guidelines](#).

1. Renovators Should Ensure They Do Not Make Radon Worse

- 1.1. We suggest renovators do as much as is reasonable to take full responsibility for ensuring radon problems they contribute to are dealt with. This means investigating radon issues before, during, and after a renovation and taking reasonable steps to address increases in radon that may have been wholly or partially caused by the renovation.
- 1.2. Where it is not feasible for renovators to ensure radon is addressed during or after a renovation, they should explain radon risks to clients and obtain informed consent before proceeding to do renovation work (see section 4).

2. Follow the Building Code

- 2.1. Renovators should check whether provincial or local radon provisions apply. For instance, the British Columbia Building Code, 2018 specifies locations where radon rough-ins should be installed (see BC Building Code 2018, s. 9.13.4.2.(4) and Article 1.1.3.3. of Division B). As well, check with the local government— local governments may have the option of applying radon provisions if they have evidence that radon is a problem in homes in their area (see BC Building Code, 2018, s. 1.1.3.3.(2)).

- 2.2. Assess whether the renovations may trigger the need for building code updates. There may be general language in the code that an alteration cannot lessen existing performance (BC Building Code, 2018, sec.1.1.1.2). If the renovation occurs in a radon prone area, and may significantly change airflow and ventilation and so make radon worse, code radon provisions may apply.
- 2.3. When building a radon system take proper care to make sure the proper piping is used, the foundation is properly sealed and the system can be activated with a fan. [BC Lung research on Building Code implementation](#) found many houses we studied had faulty systems even after passing municipal inspection. We recommend using the most recent iteration of the Canadian General Standard Board's radon guidance— currently [Radon control options for new construction in low-rise residential buildings, CAN/CGSB 149.11-2019](#). This provides details on best practices for building different levels of radon systems. We recommend “Level 2” or “Passive systems”, in which a full vent pipe is provided. Well-built passive systems will be sufficient to get many (but not all) homes within Canada's Radon Guideline. Radon systems built to this standard can also comply with your local code.
- 2.4. Whether following your provincial or local building code or Canadian General Standard Board's guidance there is still a chance that a home will still be over 200 Bq/m³. There will be still be a need for long-term radon testing after renovation is complete and occupancy resumes (see section 5).

3. Know Radon Risks

- 3.1. Even if building code radon provisions do not apply to a renovation there may be increased risk of radon.
- 3.2. Signs of increased risk include:
 - 3.2.1. history of high radon in the building
 - 3.2.2. An existing active radon system (e.g. with a fan attached)
 - 3.2.3. Other homes in the community having high radon—renovators should consult maps such as the [BC Radon Map](#), which indicates a radon problem in many communities.
- 3.3. In locations where a significant percentage of homes are over 200 Bq/m³ it may be cheaper and easier to install a passive radon system at the time of renovation rather than waiting for post-renovation testing and hiring professional mitigators. Renovators should make this assessment on a case by case basis.

4. Secure Client Consent and Provide Knowledge

- 4.1. In some cases it will not be practicable for renovators to address radon— such as where it is clear that radon testing and mitigation will happen at a much later date. In any cases where renovators cannot oversee radon testing and mitigation, they should obtain informed consent from clients.
- 4.2. Informed consent procedures should include standardized forms, and include the following information:
 - 4.2.1. Renovations can increase radon levels.
 - 4.2.2. Radon creates risks of lung cancer with higher risks from higher concentrations.
 - 4.2.3. Health Canada has set a Radon Guideline of 200 Bq/m³.
 - 4.2.4. Post-renovation testing will be necessary to learn radon levels, and
 - 4.2.5. Radon levels can almost always be reduced to below 100 Bq/m³ by radon mitigators certified by the Canadian National Radon Proficiency Program.

- 4.3. Informed consent forms should be signed by clients in the presence of the renovator or his or her employees or agents before any renovation work begins.
- 4.4. When a renovator takes responsibility for addressing radon, they should educate the client about radon and its risks, and explain the process of testing and mitigation that will be conducted.
- 4.5. Clients should be educated about any radon test results and radon reduction measures performed, overseen, or contracted for by the renovator.

5. Radon Testing

- 5.1. Ideally, radon levels will be known before renovations occur. If radon levels are known before a renovation, re-testing after a renovation is complete will provide clear evidence as to whether the renovation changed radon levels.
- 5.2. We do not recommend short term radon tests (typically up to four days in duration) as these are liable to provide false positives and false negatives. If testing prior to renovation is not possible, it should be assumed that renovations will contribute to any elevated radon discovered post-renovation (see sec.9 below)
- 5.3. In some cases there will be an existing active radon system (with a fan). This suggests in the past a radon problem was identified in the home. Post-renovation testing will still be important to ensure the radon system is calibrated to the new home conditions.
- 5.4. In all cases, radon should be tested after any major renovation.
- 5.5. Testing can be performed by Canadian National Radon Proficiency Program (CNRPP) certified radon testing professions, by renovators or by home occupants. If the renovator and client agree the client will test, the renovator should receive written and signed confirmation. CNRPP has a database of certified radon professionals on its [website](#).
- 5.6. Testing should conform to Health Canada's [Guide for Radon Measurements in Residential Dwellings \(Homes\)](#). BC Lung has co-authored a simple to use [Checklist for Radon Testing](#) based on that Guide. Completing that checklist will minimize any disagreements over testing.
- 5.7. Radon should be tested using CNRPP certified testing devices, for at least 91 days. Inexpensive 'alpha track' monitors meet this criteria and are available at leading retailers or from the British Columbia Lung Foundation on our [website](#), by email: info@bclung.ca, or by phone: 604.731.LUNG (5864).

6. Fixing Existing Radon Systems and Installing New Systems

- 6.1. Renovators should assess whether there is an existing radon system and its condition. Existing systems may need to be checked for cracks or holes, and inspected to see that any added fans are working.
- 6.2. If the system appears to be in good order, and will not be affected by the renovation, the best approach will be to test after renovation and if radon levels remain elevated, bring in a C-NRPP certified radon mitigator.
- 6.3. In some cases there will be obvious problems with the radon system that will be cheaper to fix at the time of renovation than waiting for post-renovation testing. For instance, in [Radon and the Building Code: Assessing Implementation](#) we found radon pipes were built into walls making the addition of a fan impossible. Renovators should assess on a case by case basis if it will be cheaper and easier to install a passive system at the time of renovation or wait for a radon mitigator to retrofit later.
- 6.4. Even if clients consent to take responsibility for radon, renovators should take reasonable steps to facilitate and minimize the costs of adding radon systems later, such as through ensuring a

membrane under the slab, proper sealing of foundation joints or sumps, or ensuring space to add vent pipes.

7. Ventilation

- 7.1. Balanced mechanical ventilation is an excellent way to ensure good air quality in a building. In some, but not all cases, it can also reduce levels. As well, balanced mechanical ventilation systems can act synergistically with well built passive radon systems. We recommend energy renovations include balanced ventilation systems.
- 7.2. In balancing mechanical ventilation, all sources of ventilation need to be considered. Renovators should be warned that exhaust-only ventilation systems (such as kitchen range hood fans) can increase radon levels through depressurizing interior space.
- 7.3. Automated balancing is preferable given occupants may not reliably operate manual systems.

8. Post-Renovation Testing

- 8.1. If prior radon levels are known, and post-renovation testing shows an increase in radon levels, renovators should act to ensure they are not causing harm.
 - 8.1.1. If post-renovation radon levels are at or over 200 Bq/m³ C-NRPP certified radon mitigation professionals should be hired to troubleshoot existing radon systems or to install new ones. This should be overseen by the renovator unless occupants had given informed consent to handle radon problems from the outset.
 - 8.1.2. If post-renovation radon levels are under 200 Bq/m³ renovators should educate clients and receive informed consent as to how to proceed.
- 8.2. If prior radon levels are not known, and post-renovation testing shows elevated levels, renovators should assume energy efficiency upgrades contributed to the problem and take steps to remove radon risks.